Thesis Portfolio

The Effect of Hornerin Knockdown on Tumor Vasculature in Melanoma
(Technical Report)

Overcoming Barriers to the Incorporation of Diagnostic AI in Medicine:
Lessons from Previous Innovative Medical Technologies
(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

The technical report focuses on an optimized vessel analysis software, specifically for application in research, dealing with the analysis of the blood vasculature. For the technical project, the optimized software was utilized as a research aid to assess the impact of the knockdown of a therapeutic target in melanoma. The STS research paper, on the other hand, follows a few case studies, utilizing them as a model to explore the barriers to the implementation of Diagnostic Artificial Intelligence within the field of medicine. Although starkly different at face value, these projects have the underlying similarity in utilizing complex computational tools in a medical context to improve existing workflows, by decreasing workloads and improving efficiency. Therefore, the technical report delivers a computational tool utilized to advance medicine whereas the STS research paper takes on assessing the potential societal impact of a highly disruptive, emerging medical computational tool.

The technical report has a two-fold aim: first, to deliver an optimized vessel analysis software, and second, to characterize the effect of hornerin knockdown on vessel normalization in melanoma. Hornerin, a protein, has been identified as a component of a compensatory pathway in angiogenesis, or blood vessel growth, and thus, offers a potential target for treatment in melanoma. The current vessel analysis software requires lengthy and manual analysis of blood vessel parameters. With an optimized vessel software, parallel processing capabilities will allow users to more quickly and effectively characterize the effect of a therapeutic on vessel normalization. Specifically, in the context of the technical report, the optimized vessel analysis software will be applied to characterize the effect of hornerin knockdown, using hornerin siRNA, on vessel normalization in melanoma.

The utilization of computational aids has become a mainstay in medical research. Similarly, this trend has also slowly taken hold within the field of clinical medicine. The use of artificial intelligence as an aid to diagnosis is the next frontier for this trend as the technology has the potential of revolutionizing the healthcare industry as we know it. At the same time, medicine is no stranger to technological innovations, and therefore it may be beneficial to peruse previous innovative technologies within the field that have had a largely disruptive and influential effect. By looking at the case studies of laparoscopic surgery procedures and Electronic Health Records, and examining the different forms of resistance that emerged to their implementation, barriers that may emerge to the use of diagnostic AI in medicine can be elucidated.

The goal of both these research projects is to further advance the quality of medical care, either directly, through the use of computational tools like the optimized vessel analysis software to investigate a novel therapeutic target for melanoma, or indirectly, through identifying the barriers to the implementation of diagnostic AI so that we are better prepared to incorporate a technology that has the promise of revolutionizing and improving medical care.